

# FTTH IN MATURE BROADBAND MARKETS: QUO VADIS?

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## ABSTRACT

Next-generation networks are being deployed across the globe. However, existing broadband infrastructure may hinder future investments in these networks in mature broadband markets. While broadband providers are faced by demand uncertainty, policymakers have to deal with uncertainty at both the supply and demand side of fiber broadband markets. Discussing the results of a large-scale user survey, this paper proposes different scenarios for dealing with the demand and investment uncertainty in Western Europe.

## KEYWORDS

Private-public nexus, market, demand, investment, fiber broadband.

## 1. INTRODUCTION

All over the world telecommunication incumbents, utility companies and local municipalities are in the process of investing in next-generation networks. More recently the focus shifted from the backbone to the access network and the last mile problem. The global market for fiber to the home (FTTH) is growing fast, but market growth and investments are fragmented across different parts of the world. Whereas this business flourishes especially in Asia and Eastern Europe, investments in Western Europe (except for the Nordic countries) remain below expectations (Chaillou, 2010). These disparities in deployments around the world mainly result from the available telecommunication infrastructure of the incumbents or from a lack of resources. Indeed, existing broadband infrastructure is the primary barrier or enabler for FTTH deployment in Western Europe and largely explains why some regions are experiencing difficulties moving from copper or cable infrastructure to FTTH technology. Generally, technological, regulatory and market developments increase the uncertainty that the investments will pay off (IDATE, 2010). In the Belgian market, characterized by two well-established xDSL and cable networks resulting from universal service obligations, incumbents seem reluctant to roll out FTTH networks. However, in other European countries, such as Sweden, Norway and the Netherlands for example, governments and local municipalities have committed to sponsor broadband programs and supported the roll out of open access infrastructure (Kramer et al., 2006).

In its Digital Agenda, the European Commission (2010) defined its strategy for playing a leading role in the global ICT economy including the promotion of national deployments of broadband network infrastructure. Also Member States have released national broadband policies to foster economic growth and promote high-speed broadband offerings. It is believed that ultra-broadband access networks will attract new investments and enhance the establishment of the European information society by the provision of value-added services for public administration, education, healthcare, culture etc. However, the premise that

superfast broadband will bring substantial economic and social benefits is not commonly shared and can even be criticized. Kenny & Kenny (2011), among others, suggest that billions of public money may be even wasted by being spent to deploying FTTH networks. Although these externalities may be unproven, future traffic congestion and network saturation urge the need for rolling out of next-generation networks.

## 2. THEORETICAL FRAMEWORK

The public-private nexus focuses on the interplay between technology supply, business strategies, consumer demand and market regulations. As Ruhle & Reichl (2008, p. 19) state, “*market uncertainty comprises two aspects: uncertainty on the demand side ('demand uncertainty') and uncertainty on the supply side ('investment uncertainty')*.” This urges the need for a more holistic overview of the three main stakeholders in the FTTH market: telecom operators, consumers and policymakers.

Since technological developments and consumer demands are constantly evolving, telecom operators are confronted with rising capital expenditures for upgrading existing networks and deploying new network infrastructure. In recent years, incumbents were forced to invest substantial amounts of money in backbone and access networks. However, the cost of deploying FTTH networks on a European level are estimated at €270 billion (up to €5 billion in Belgium) (Lannoo et al., 2006). EU Commissioner Kroes recently promised to stimulate the investments by offering €9.1 billion to incentivize incumbent's investments in fiber broadband, but incumbent broadband providers stay reluctant to deploy new infrastructures. But rather than for financial reasons, incumbents may fear cannibalization of their existing businesses and may wish to preserve their (existing) business model. As Montagne et al. (2010) argue, investments in next-generation access networks by telecom companies are mainly driven by competition and regulation, and only to a lesser extent by market demand. Rather than investing in fiber broadband, incumbents tend to upgrade existing networks. Whereas cable operators migrate to DOCSIS 3.0, telecom incumbents seem committed to VDSL2 to counter the FTTH threat. In addition, incumbents are implementing new techniques (like pair bonding and vectoring) to accelerate transmission speed. These companies also fear they will be obliged to grant wholesale access to smaller rivals and new entrants if they invest in FTTH. In this respect, regulatory uncertainty may act as a barrier for investments as well (van Gorp & Middleton, 2009). To cope with market uncertainty, operators mainly search for densely populated areas or start deploying networks only when a given percentage of the market intends to subscribe to the network. Given all these uncertainties, incumbents are currently not the driving force behind fiber broadband. Instead, the FTTH market is driven by alternative telecom operators and utility companies (electricity, water, housing) that are developing their own network infrastructure to compete in the market (Tadayoni & Sigurðsson, 2007). But also external companies such as investment funds or content providers decided to invest in FTTH. In most instances, these companies engage with local municipalities or governments to establish public-private partnerships (PPP) to be able to accumulate funds and knowledge. The strategy and goals of PPPs are various and range from overcoming market failure, or spurring economic growth to bridging digital divides (Cave & Martin, 2010; Nucciarelli et al., 2010, 2010; Sadowski, 2009). Not only goals may differ, also ownership structures can vary largely. The involvement of (local) governments ranges from facilitator to developer of a project, this may affect the business model, funding, infrastructure and how demand is handled (Troulos & Maglaris, 2011). One of the risks is that this investment results in an inefficient and patchy network with incompatible standards or documentation (Huigen & Cave, 2008).

In addition to these investor and infrastructure developer roles, governments can also operate as users and regulators (Gillett et al., 2004). In the past, regulation was conveyed at the national level and operators were, with the exception of the UK, monopolists (van Kranenburg & Hagedoorn, 2008). While liberalizing the industry in the 1990s, telecommunications became international and supervised by EU governmental institutions. In addition, telecommunication policy is marked by the enduring trade-off between competition and innovation. Policymakers could stimulate open competition, but are able to incentivize investments in network infrastructure (Cambini, 2009). It is often hard to predict the outcome of regulation. In the context of FTTH deployments, policies can focus on either open access regulation (service competition) or competitive networks (infrastructure competition). In any case, telecommunications policy and regulation should ideally facilitate economical activities and the provisioning of innovative services. Next to this more industrial policy, governments justify their investments in next-generation networks with the reasoning that they can

execute policy objectives themselves. Stimulating economic development, providing access to e-government services and overcoming the digital divide are often referred to in this context (Ida & Horiguchi, 2008). However economic interest outweighs social factors. Specific attention should be devoted to bridging the digital divide, ensuring that all citizens have equal access to broadband infrastructure and that they can fully participate in the information society. As the digital divide is increasingly seen as a multidimensional concept complementing access with attitudes and skills, this entails e-inclusion policies that are specifically targeted towards different groups of the population (van Dijk & Hacker, 2003, Verdegem & Verhoest, 2009). One of the factors that may complicate digital divide policies is that access is often a household decision whereas usage is an individual decision (Brown, 2008). Apart from the binary (but also false) opposition between 'haves' and 'have-not's', the roll-out of next-generation networks imposes a new digital divide between people with ultrafast broadband Internet and those with slower connections (Prieger & Hu, 2008). Broadband providers have also offered special packages to convert this segment into customers. Policymakers are entitled to stimulate or facilitate developments at both sides of the market. Therefore, next-generation access and the digital divide are sometimes seen as two sides of the same coin that demands an integrated approach to ensure that not only FTTH's economic benefits are realized, but also that the service generates social externalities. A problem that may arise is that investments are usually made by local governments whereas national or European institutions create the legal framework. It is therefore necessary that these initiatives are clearly aligned.

In order to deal with demand uncertainty, both public authorities and broadband service providers need to step beyond generic strategies and policies but have to consider the specific dynamics, and the geographic, social and demographic structure of local markets. These features may heavily affect the outcome of investments and regulation (Ragoobar et al., 2011). In densely populated areas, for example, fixed costs can be divided amongst more consumers. This decreases subscription fees, which may in turn spur consumer adoption (Frigo & al, 2004). Since critical mass is required to finance broadband projects, this explains why most FTTH deployments are currently limited to cities or specific areas (van Gorp & Middleton, 2009). In the remaining parts of the paper, market demand for FTTH in a Belgian city is assessed and the implications for the incumbents and policy are discussed.

### 3. METHODOLOGY

The empirical data presented in the paper were collected by means of an offline questionnaire. The assessment of the market demand for FTTH has been limited to the case of Ghent, the third largest city in Belgium housing more than 250,000 inhabitants and over 20,000 students. In total, a representative sample of 2,000 registered inhabitants were selected and invited to join the study. Eventually, 516 respondents filled out the questionnaire, resulting in a response rate of 25.8%. By comparing the sample with official statistics provided by the city of Ghent, it can be concluded that the sample is relatively representative for the total population of Ghent. After being familiarized with the innovation, people were asked about their opinion and attitudes towards the technology and its applications.

The demand assessment mainly relies on the diffusion of innovation theory elaborated by Rogers (2003). According to this theory, the diffusion of an innovation in society follows a bell-shaped pattern amongst five adopter segments: innovators, early adopters, early majority, late majority and laggards. However, traditional intention-based surveys ('*Would you be interested in ...?*') typically overestimate market potential (Bennett & Kottasz, 2001). Therefore, the product specific adoption potential (PSAP) scale was applied to obtain a more accurate reliable forecast of the market potential for FTTH. The PSAP method calibrates the overestimations of traditional intention surveys to a more reliable level of personal 'optimal' and 'suboptimal' product offerings (including pricing and features) (De Marez & Verleye, 2004). Although it may be hard to make valid predictions for a period longer than two years, the method has been applied and validated for several new technologies (De Marez et al.; 2011, Verdegem & De Marez, 2011). A limitation of this paper is that the respondents were not familiar with the technology since they were not able to test FTTH and its applications in practice. Furthermore, consumers' needs and expectations can evolve in the coming years. The potential of mobile technologies was also underestimated due to these factors. Since it takes a long time to roll out FTTH, this has to be taken into account.

## 4. RESULTS

### 4.1 Internet connection

Due to their wide availability, cable (55.7%) and xDSL (34.4%) are the most popular access technologies amongst the respondents, which implies that a considerable amount of consumers have access to broadband networks. In general, people are quite satisfied with their current Internet connection, which suggests that people have little motivations for migrating to better performing network technologies without additional benefits. The respondents seem most satisfied with network reliability, capacity (download and upload volume) and bandwidth/speed (Figure 1). Although fiber broadband promises a better Internet experience regarding these particular features, people seem already relatively satisfied about them. A regression analysis indicates that these features have the largest impact on customer satisfaction.

On the other hand, respondents indicate load time and response time as future action points (towards an optimal quality of experience) for the Internet service providers. This is where FTTH technology is said to make a clear difference compared to existing networks, but this raises the question whether these features will convince consumers to migrate to fiber. The perceived high subscription costs and the rather poor price/quality ratio are two recurrent findings. Given the substantial deployment investments and the lack of economies of scale, it is questionable that FTTH service providers can successfully position a more expensive service without additional benefits in a competitive market.

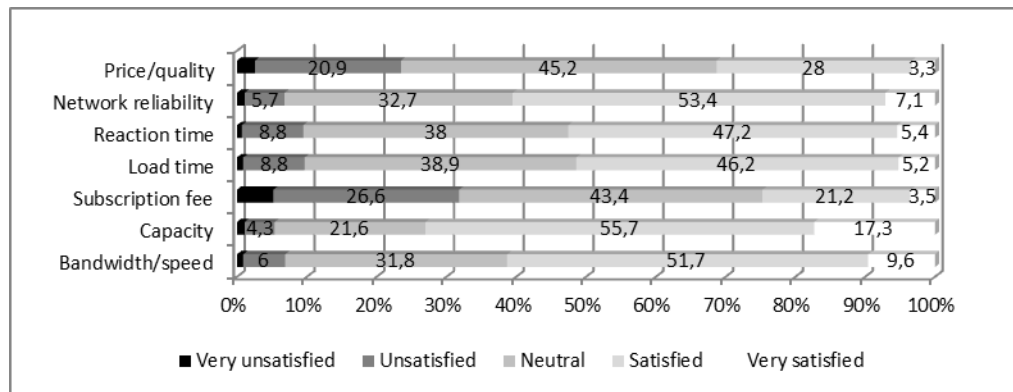


Figure 1. Satisfaction with current Internet connection (N: 470)

### 4.2 Market demand

By applying the PSAP segmentation forecast method on the stated intentions of 516 respondents, a reliable view on the size and nature of the adopter categories for FTTH in Ghent can be obtained (Figure 2). Contrary to the expected normal shaped distribution, the end result is a double-peaked curve. This suggests that there is certainly some market potential for FTTH although providers have to deal with a rather dual market perspective. There is a substantial part of earlier adopters, as innovators (5.2%) and early adopters (10.3%) are overrepresented compared to Rogers' predicted pattern. On the other hand, 73% of the respondents are classified as either late majority or laggards. This significantly exceeds the theoretical assumption. In other words, market demand is characterized by a dedicated niche segment on the one hand and a rather large apathetic mass on the other hand. Typical for such dual markets is the presence of a 'chasm' that needs to be bridged when assuming full market penetration. Apart from attracting the innovator and early adopter segments, which acknowledge the added value of ultra-broadband, providers will need to bring other segments, which are more reluctant to migrate to FTTH, on board as well. This will have implications in terms of marketing and targeting the service to the community. With regard to adopter profiles, (statistically) significant relationships between behavioral innovativeness and age, usage, housing type and employment were found. Younger people and people that use the Internet more often, tend to be more interested in FTTH. Students, entrepreneurs and managers are also more likely to be innovators. There were significant differences between the amount of earlier adopter and later adopters in the examined regions. However, these

results are hardly applicable to other parts of the country or other countries, since socio-cultural differences and even market structures may cause different usage and adoption patterns. Regarding gender, education level, income level, urbanization level and family size, no significant relationships were identified.

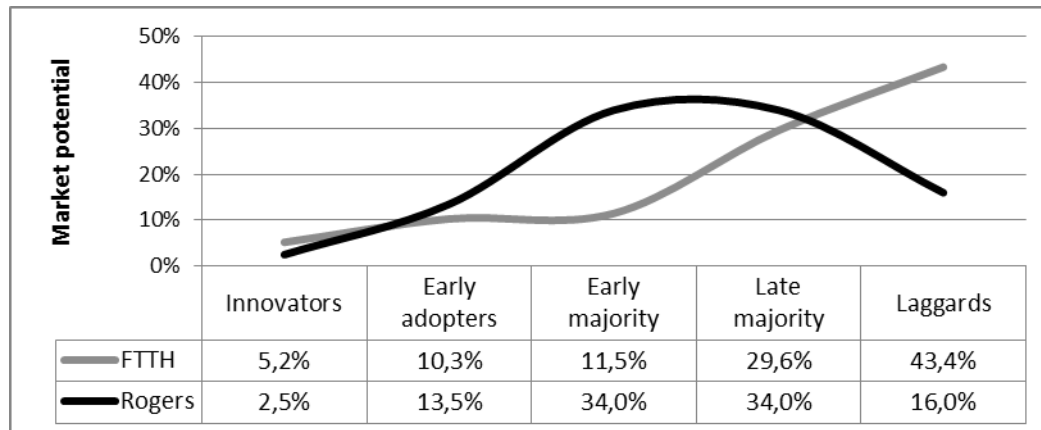


Figure 2. Overview of the market potential of FTTH in Ghent (N: 460)

### 4.3 Willingness to pay

As indicated, migrating to FTTH is only considered by a relatively small group of people (some 16% of total market), which are willing to pay a premium price on top of their current subscription fee for enjoying the benefits promised by FTTH. Generally, willingness to pay is (not surprisingly) significantly higher among innovator and early adopter segments. Whereas innovators are willing to pay an average premium of €9.98 a month, this price is limited to €5.88 amongst the late majority segment while the laggards do not want to pay additionally. The bulk of the innovator and early majority segments seem willing to migrate to ultra-broadband services (unlimited capacity, min. 50Mbps upload and download speeds) whereas the early and late majority segments prefer a broadband connection (limited capacity, 16Mbps download and 2Mbps upload speed).

In the other parts of the questionnaire price sensitivity was examined. Almost 72% of the sample is willing to upgrade to FTTH when this service would be provided at a price similar to the one they are currently paying for their connection. In this scenario, no chasm can be identified suggesting that this marketing strategy may be close to optimal, but hands no further incentives for providers to invest in new network infrastructure (since the price premium is zero). This interest drops to 11.3% when introducing the service at current prices increased with €10. When charging premium prices, market demand rapidly declines but also allows broadband providers to better monetize their investments in new network infrastructure.

### 4.4 Services

Obviously, this willingness to pay is influenced by the perceived added value for consumers. In this context, new applications may trigger market demand for FTTH. Innovators see added value in multi-screen usage, video telephony and high-quality video streaming, which quality of experience is assumed to substantially improved with FTTH. Laggards, on the contrary, are more interested in existing but basic services such as e-mailing and video websites. They especially stick to applications that they are already familiar with, and are not really interested in innovative services like health monitoring or advanced educational services. Since especially the early majority showed interest to these applications, innovative services that create social externalities, such as in the domain of healthcare, government and education, could be crucial in illustrating the value added of fiber broadband to this rather substantial segment. Online multiplayer gaming and security cameras were found the least convincing use cases for people to migrate to ultra-broadband access networks. For all of these services there was a significant difference between the adopter categories in terms of interest.

At the moment the services that are only supported by FTTH are fairly limited. Most of these can be facilitated with the existing network architecture.

## 5. DISCUSSION

In this paper, the question was raised to what extent existing broadband infrastructure is a hampering factor in the roll-out of fiber based networks. It was argued that uncertainties at both the demand and supply side may slow down the development of these markets and that policymakers are entitled to stimulate or facilitate development at both sides of the market. In general, the results show that demand for fiber-based networks is relatively low and that a large part of the market is indifferent to superfast broadband. This limited market demand is marked by several indicators. Firstly, people seem relatively satisfied with the speed and capacity of their current Internet connection. Secondly, the majority is not convinced by the proposed services and see little added value of innovative services. Furthermore, willingness to pay is crucial. The results suggest that only a small part of the population is willing to pay a premium price for fiber broadband, but that almost 72% of the sample is willing to migrate to fiber when it is offered at current prices. Since the survey was held in a mature broadband market, however, the results may not be applicable for those markets where broadband infrastructure is still under-established. The wide availability of performing broadband connections that are offered at competitive prices may largely influence adoption decisions. Providing bundles at competitive prices would create convenience and may spur FTTH adoption rates. In this context, socio-cultural and economic contexts may affect adoption rates of FTTH connections and investment uncertainties. However, this uncertainty is mainly influenced by the degree of competition in the market and the impact of regulation since these factors have an impact on the willingness to invest in new networks.

Based on the level of these demand and investment uncertainties, four different scenarios can be outlined (see Figure 3). In each of these scenarios, a combination of both market uncertainties are discussed. For each scenario, opportunities for public and private actors are described and a possible strategy for overcoming uncertainties is proposed. Although these scenarios may be regarded as static and oversimplified, we believe this model helps identifying those market situations where government intervention may be needed to facilitate the development of fiber broadband markets.

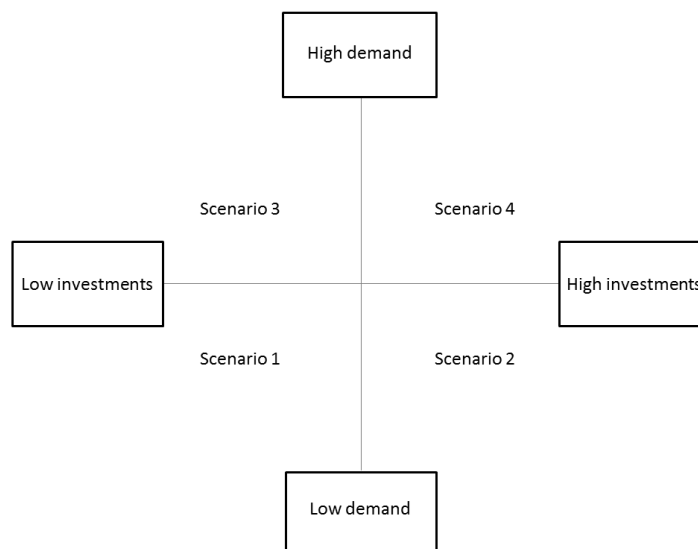


Figure 3. Overview of the proposed scenarios

*Scenario 1:* When market demand is low and operators are not eager to invest in new infrastructure, this scenario is characterized by a chicken-or-egg problem. Operators are reluctant to roll-out FTTH as there is limited demand while this demand is not triggered by absence of infrastructure. In this context, operators are likely to upgrade existing infrastructure so that there may be an important role for government for stimulating FTTH development in such markets. A possible solution for overcoming this Catch-22 problem could be the establishment of a publicly owned network. In such a scenario, local authorities invest in passive network infrastructure (backhaul) and provide open access to interested telecom operators and service providers to use this network. This way, governments secure that fiber broadband infrastructure is deployed. Incumbents tend to react fiercely to these projects so there are no guarantees that these market players will lease network capacity and that consumers will migrate to FTTH. Thus, the appropriateness of public intervention in such markets can be questioned since investments are high and market uncertainties remain.

*Scenario 2:* In this “*If we build it, they will come*” scenario, broadband providers or other companies are investing in next-generation networks and try to trigger market demand. They can achieve this by bundling services, reducing prices and stimulating complementary innovation in compelling services. By aggregating market demand, these providers can assure critical mass, realize economies of scale and provide consumers access at lower prices. To overcome this high investment and to increase the ARPU (average revenue per user), companies can decide to apply new business models. This can have an effect on net neutrality. On the other hand it is also possible that more service providers are active on the same network so that the choice increases and net neutrality is not an issue. Governments can play a role in providing e-government services or by subsidizing the purchase of modems that are needed for fiber broadband. However, this may trigger the interest of competition authorities as this approach is not technology-neutral.

*Scenario 3:* Ideally, market demand should attract investments, but regulatory and especially financial thresholds may hamper willingness to investment. One possible strategy to overcome these barriers is setting up PPP constructions since lack of appropriate funding may be the main reason for telecom operators for not investing in fiber broadband. In this context, the provision of public subsidies can act as a catalyst for investments on the supply side. This can stimulate other operators to invest in additional infrastructure and increase competition in the market. However, the question raises to what extent a duplication of fiber broadband infrastructures (i.e. the ladder of investment approach) is socially and economically desirable. Sharing the network investments is another option.

*Scenario 4:* The combination of high market demand and high investments is the optimal situation for a fast FTTH roll-out and secures a high take-up rate. In first instance, no government intervention is needed as this is an example of perfect markets. However, this does not guarantee that operators will provide wholesale access to other operators. Consequently, competition in FTTH markets is not assured. This might stimulate policy intervention in order to stimulate rivalry and decrease prices.

The implications of this paper are both practical and theoretical. The results might help local municipalities and other interested companies while assessing the feasibility of fiber broadband deployments. Especially in mature broadband markets, these conclusions are applicable and may raise a couple of related issues. The delicate interplay between the different stakeholders should be considered since the dialectic between market, policy and users might affect the outcome of the FTTH diffusion. Further research should focus on the determinants for demand and investments, and on approaches to deal with uncertainties on both sides of the market. Hence, the model proposed in this paper can be applied to manage the risks related to the deployment of fiber broadband infrastructure.

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